



# Family Health Dataline

## IN THIS ISSUE:

This issue of the Dataline presents information from a recent study examining risk factors for Invasive Pneumococcal disease among children from Bethel, AK. Significant findings include:

- The odds of pneumococcal illness was much greater among children who attended group child care compared to those who did not attend group child care (odds ratio, 98.6).
- The odds of pneumococcal was less among children who had been breast-fed compared to those who had never been breast-fed (odds ratio, 0.1).
- The odds of pneumococcal illness was greater among children who lived in a household where at least one person chewed tobacco compared to children who lived in a household where no one chewed tobacco (odds ratio, 20.6).

## Risk Factors among Children for Invasive Disease Caused by *Streptococcus Pneumoniae*\*

\*This Dataline represents a summary of information contained in reference 1

### Introduction

The encapsulated bacteria *Streptococcus pneumoniae* is a major cause of pneumonia, bacteremia, and meningitis, particularly among Alaska Native children of the Yukon-Kuskokwim Delta (YKD) for whom the reported annual pneumococcal disease incidence rate is 7 to 12 fold higher than among children from other sites in the United States (2-4). The morbidity and mortality associated with pneumococcal infections and the recent emergence of drug-resistant strains of *S. pneumoniae* makes the identification of prevention strategies particularly urgent. Unfortunately, currently available vaccines do not provide adequate protection to children <2 years of age. To identify potentially modifiable risk factors for pneumococcal disease, we evaluated a group of Alaska Native residents of Bethel, Alaska <2 years of age.

### Methods

The Arctic Investigations Program (AIP), National Center for Infectious Diseases, Centers for Disease Control and Prevention has conducted active surveillance for pneumococcal disease in YKD since 1982. From January 1983 through February 1992, AIP identified 186 episodes of pneumococcal illness among all YKD residents; from this group we identified 29 Alaska Native children <2 years of age at the time of illness who had lived in Bethel from birth until the date of illness onset. We restricted our analysis to Alaska Native children who had lived in Bethel their whole lives because this group had essentially complete medical records for review.

To determine risk factors for illness, we used a 1:3 matched case-control design. For controls, we selected persons who had a date of birth within 5 days of their matched case-patient, were Alaska Natives, and had lived in Bethel from birth until the date of illness in their matched case. For two patients, only two controls each were identified. The study interval for all exposure variables was from birth until the date of diagnosis of pneumococcal disease in the case-patient.

Data were collected from two sources: hospital records at the Yukon-Kuskokwim Delta Regional Hospital (YKDRH) and a standard questionnaire administered by telephone to the parent or guardian of cases and controls. Although almost 10 years had passed since the first case-patient had become ill, the relatively stable residency of Alaska Natives in Bethel allowed us to contact and interview 77 of the 114 case-patients and controls in our study during the telephone interview.

We conducted a matched univariate analysis for each independent variable. Six variables that, on univariate analysis, were associated with illness at a significance level of  $P \leq 0.25$  were entered into a multivariate model and analyzed by conditional logistic regression. Two other independent variables, congenital heart disease (CHD) and gestation < 36 weeks, were statistically significant risk factors but were not entered into the final multivariate model because few case-patients and no controls had the risk factor of interest.

## Results

Among the 29 case-patients identified, five had bacteremia without a known focus; three had meningitis, of whom one also had otitis media; 14 had pneumonia, of whom seven had otitis media; and seven had otitis media without pneumonia or meningitis. *S. pneumoniae* was isolated from the cerebrospinal fluid of case-patients with meningitis and the blood of all other case-patients. Eight children (28%) had congenital anomalies or adverse birth-related events, including four with CHD, four with gestation < 36 weeks, and one with metabolic acidosis of unknown etiology associated with failure to

thrive. One child had both CHD and gestation < 36 weeks. Three children had more than one episode of invasive pneumococcal disease before two years of age, two with three episodes and one with two episodes; a fourth child had a second episode at 3 years of age.

## Case-control study

We abstracted medical record data of 29 case-patients and 85 controls and were able to contact and collect information for 22 case-patients and 55 controls during telephone interviews. (Table 1) Four of 29 case-patients had CHD and 4 of 27 case patients had gestation < 36 weeks compared with none of 85 controls.

**Table 1.** Odds of invasive pneumococcal illness associated with various potential risk factors; Bethel, Alaska; 1983 to 1992.

Potential Risk factor	Cases No./total	Controls No./total	Matched odds ratio (P)
<i>Variables from chart review</i>			
$\geq 1$ prior episodes of pneumonia or bronchiolitis	12/29	22/85	2.6 (0.16)
$\geq 1$ prior hospitalizations other than birth	11/29	21/85	1.9 (0.23)
$\geq 5$ prior episodes of otitis media	12/29	43/85	0.5 (0.45)
Male	16/29	51/85	0.8 (0.81)
Antibiotics during the last month of the study interval	13/28	44/84	0.9 (0.86)
Otitis media during the last month of the study interval	15/29	43/85	1.1 (1.00)
<i>Variables from telephone interview</i>			
Group child care attendance	9/22	4/55	21.7 (<0.001)
$\geq 1$ tobacco smoker in household	18/22	31/53	3.5 (0.08)
Breast-fed for any length of time	11/22	38/53	0.3 (0.18)
$\geq 1$ tobacco chewer in household	13/22	22/54	3.0 (0.25)
Lived in a household with > 1 person per room	14/22	23/54	2.3 (0.29)
At least one other child < 5 years of age in household	10/22	16/55	2.3 (0.41)
Food pre-chewed by another person	15/22	36/54	1.4 (0.87)

Based on results of matched univariate analysis, the following variables were included in the multivariate model: attendance at group child care, the presence of at least one tobacco cigarette smoker in the household, the presence of at least one tobacco chewer in the household, the occurrence of at least one prior episode of pneumonia or bronchiolitis, at least one prior hospitalization other than birth, and breast-feeding for any length of time before illness.

Of the 77 persons for whom information from the telephone interview was available, 20 case-patients and 41 controls (for whom the value of all independent variables of interest was known) were included in the multivariate model. Prior hospitalization was removed from the model first followed by the presence of at least one tobacco cigarette smoker in the household and the occurrence of at least one prior episode of pneumonia or bronchiolitis. Group child care attendance, the presence of at least one tobacco chewer in the household and breast-feeding were independently associated with illness, although the upper 95% confidence limit for breast-feeding was 1.0 (Table 2).

**Table 2.** Conditional multiple logistic regression analysis of risk factors for invasive pneumococcal illness; Bethel, Alaska; 1983-1992.

Risk factor	Coefficient	Odds ratio (95% CI*)
Group child care attendance	4.6	98.6 (5.1-1920.6)
≥1 tobacco chewer in household	3.0	20.6 (1.4-294.5)
Breast-fed for any length of time	-2.1	0.1 (0.0-1.0)
* Confidence interval		

## Discussion

We have identified three environmental risk factors associated with pneumococcal illness which may be targeted for prevention strategies. Attendance at group child care was most strongly associated with illness. Previous studies have demonstrated an association between group child care attendance and invasive disease caused by *Haemophilus influenzae* (5,6) and *Neisseria meningitidis* (7) as well as respiratory infections. The mechanism by which group child care attendance may increase the risk of invasive pneumococcal illness, and illness from other encapsulated bacteria, is not well understood. Regardless of whether they attend group child care, most children will become colonized with at least one pneumococcal strain at some point during their first two years of life. Rather than increasing the risk of pneumococcal colonization, however, group child care attendance may increase the risk of invasive disease by exposure to other pathogens that may impair local or systemic defense mechanisms. In addition, respiratory pathogens may be more widespread and easily transmitted at group child care settings. This may result in the constant exposure of children to a wide array of pneumococcal strains, increasing the potential of exposure to strains to which a child may not have protective antibodies.

We found that breast-feeding had a protective effect although we did not evaluate the importance of duration and consistency of breast-feeding patterns. Previous studies have suggested that breast-feeding may decrease the incidence of otitis media (8) and respiratory illness (9). These findings are significant for Alaska because during 1991 to 1994, 32 to 38% of children enrolled in the Women, Infants, and Children Program (WIC) were never breast-fed and less than half were breast-fed for more than 2 months (Alaska Division of Public Health, Section of Maternal, Child, and Family Health, unpublished data). Similarly, a population-based study conducted during 1990 by Ross Laboratories found that 19% of all Alaskan infants were never breast-fed and 35% were breast-fed for less than 2 months.

We found that the presence of at least one person chewing, but not smoking, tobacco in the household was associated with illness. Etzel et al suggested, on the basis of elevated urinary cotinine measurements in children 3 to 6 years of age, that children in the Yukon-Kuskokwim Delta may be given smokeless tobacco (10). Thus, our findings may reflect use of smokeless tobacco by children in these households. Alternatively, this finding may reflect the association of tobacco chewing with other factors not evaluated during this study.

New formulations of pneumococcal vaccines linking capsular polysaccharide antigens to carrier proteins are being developed and evaluated for the prevention of pneumococcal disease in young children, in whom currently available capsular polysaccharide vaccines frequently yield inadequate antibody responses. Until

effective immunization strategies are available, our data suggest that breast-feeding may be an important strategy for substantially reducing the risk of invasive disease. Further study is needed to evaluate the impact of exposure to tobacco products. Once effective vaccines are available, children <2 years of age attending group child care may be an appropriate target group for vaccination programs.

Submitted by:

Bradford D. Gessner, M.D.

## References

1. Gessner BD, Ussery XT, Parkinson AJ, Breiman RF. Risk factors for invasive disease caused by *Streptococcus pneumoniae* among Alaska native children younger than two years of age. *Pediatr Infect Dis J* 1995;123-8.
2. Breiman RF, Spika JS, Navarro VJ, Darden PM, Darby CP. Pneumococcal bacteremia in Charleston County, South Carolina: a decade later. *Arch Intern Med* 1990;150:1401-5.
3. Davidson M, Schraer CD, Parkinson AJ et al. Invasive pneumococcal disease in an Alaska Native population, 1980 through 1986. *JAMA* 1989;261:715-8.
4. Bennett NM, Buffington J, LaForce FM. Pneumococcal bacteremia in Monroe County, New York. *Am J Public Health* 1992;82:1513-6.
5. Redmond SR, Pichichero ME. *Haemophilus influenzae* type b disease: an epidemiologic study with special reference to day-care centers. *JAMA* 1984;252:2581-4.
6. Berg AT, Shapiro ED, Capobianco LA. Group day care and the risk of serious infectious illnesses. *Am J Epidemiol* 1991;133:154-63.
7. Jacobson JA, Filice GA, Holloway FT. Meningococcal disease in day-care centers. *Pediatrics* 1977;59:299-300.
8. Aniansson G, Alm B, Andersson B, et al. A prospective cohort study on breast-feeding and otitis media in Swedish infants. *Ped Infect Dis J* 1994;13:183-8.
9. Ford K, Labbok M. Breast-feeding and child health in the United States. *J Biosoc Sci* 1993;25:187-94.
10. Etzel RA, Jones DB, Schlife CM, et al. Passive smoking and tobacco chewing among Alaskan children: measuring saliva cotinine. *J Smoking-Related Dis* 1992;3:161-5.

*Family Health Dataline* is a monthly publication of the Alaska Department of Health and Social Services; Division of Public Health; Section of Maternal, Child, and Family Health, 1231 Gambell Street, Anchorage, AK 99501, (907) 274-7626 (fax) 277-6814.

Section Chief ..... Karen Pearson  
 Editor/Unit Manager ..... Brad Gessner  
 Staff ..... Kathy Perham-Hester  
 Design/Layout ..... Kaye Saxon  
 Printing ..... Alaska Printing, Inc.



Vol. 1, No. 3

Family Health *Dataline*  
 State of Alaska, MCFH  
 1231 Gambell Street  
 Anchorage, Alaska 99501

Address Correction Requested

BULK RATE  
 U.S. POSTAGE  
 PAID  
 ANCHORAGE, AK  
 PERMIT NO. 297